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Survey of Reptiles and Amphibians of the Coastal Forests near Bega, NSW

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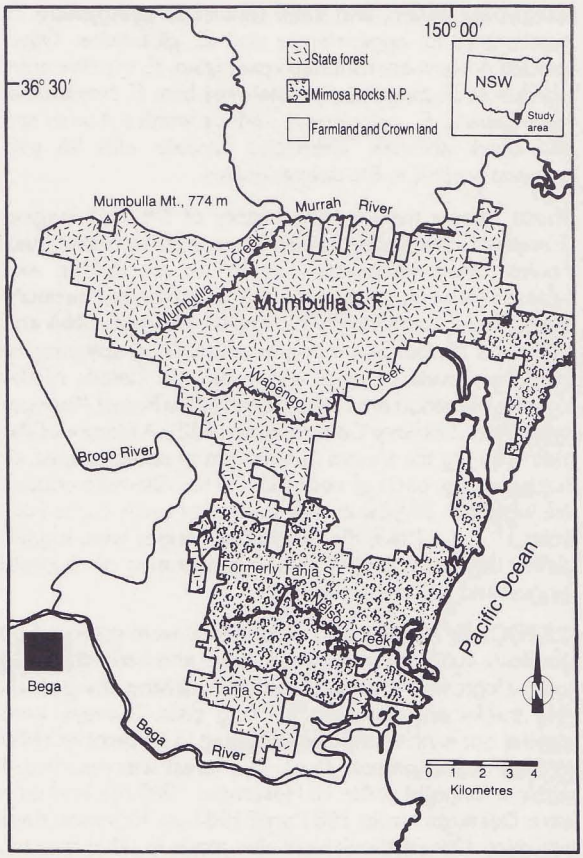
ABSTRACT: A survey of the reptiles and amphibians of the coastal forests, adjacent farmland and coastal National Park near Bega on the south coast of NSW was undertaken between 1980-84. A total of 33 species (21 reptiles, 12 amphibians) were found. Within the survey area 13 species were considered rare, seven were uncommon and 13 were common. This study extended the southern limits of *Sphenomorphus tenuis*, and presents the first record of communal egg-laying for *Pygopus lepidopodus*. There was no difference in the number of species between adjacent logged and unlogged forest, but following a fire in 1980, two species (*Egernia saxatilis* and *Pseudechis porphyriacus*) were not recorded in burnt areas in the subsequent four years of survey.

INTRODUCTION: This paper presents the findings of a five-year survey of the reptiles and amphibians of the coastal forests in the Eden woodchip area near Bega on the south coast of New South Wales. The aim of the study was to determine the distribution, status and habitat preferences of these animals in an area undergoing considerable change.

At the outset of this study in 1980 there was an absence of detailed information for the south coast of New South Wales other than a few museum records and the distribution maps of Barker and Grigg (1977) and Cogger (1979). During the course of the study, the state forests were burnt and all of the south coast was subjected to the worst drought recorded for the area (Bureau of Meteorology 1983). Fire is known to have a substantial impact on the biota (e.g. Gill *et al.* 1981), but there have been no studies on the effect of fire, with the complications of drought, on reptiles in forests.

Fig. 1. The survey area is depicted by the shaded areas of State Forests and the National Park and includes the adjacent farmland. The land to the north of Murrah River is State Forest and farmland, and to the north of Mumbulla Mountain is forested vacant crown lands and farmland.



STUDY AREA: The study area (Fig. 1) was Mumbulla and Tanja State Forests, the narrow coastal strip of heath and low open forest in Mimosa Rocks National Park, and the adjacent cleared farmland. Most of Tanja State Forest was re-dedicated in 1982 as an extension to the National Park.

The area consists of ridges and gullies on Devonian granite, conglomerates, sandstones and shales (Hall *et al.* 1967) ranging in elevation from sea level to Mumbulla Mt (774 m). The climate is within that described for the warm temperate Bassian zoogeographic region (Rawlinson 1969). The mean annual rainfall at Bega is 871 mm and is evenly distributed throughout the year. During the study, rainfall was 605 mm in 1979, 509 mm in 1980, 690 mm in 1981, 428 mm in 1982, 1008 mm in 1983 and

843 mm in 1984. On 18 November 1980 Mumbulla State Forest was burnt. During the fire there was extensive crown scorch, and all the leaf litter and ground vegetation was consumed in the blaze. The regrowth was slowed by the drought, which did not break until May 1983.

The open forests are dominated by silvertop ash *Eucalyptus sieberi*, and three species of stringybarks *E. muellerana, E. agglomerata* and *E. globoidea.* Other species present are mountain grey gum, *E. cypellocarpa,* woollybutt, *E. longifolia,* coastal grey box, *E. bosistoana,* red ironbark, *E. sideroxylon,* various wattles *Acacia* spp and black she-oak, *Casuarina littoralis* with lilli pilli, *Acmena smithii,* in the deeper gullies.

These forests have a long history of fire and logging (Forestry Commission 1982). Tanja and Mumbulla State Forests were intensively logged for woodchips and sawlogs between 1976 and 1983. A portion of Mumbulla State Forest was virtually clearfelled between 1964 and 1972 in a Timber Stand Improvement (TSI) operation to produce stands of even age regrowth. Details of the logging operation are in the Eden Native Forest Management Plan (Forestry Commission 1982). A feature of the plan is to log the forests in a pattern of small coupes, or cutting areas, each of about 10-20 ha. Alternate coupes are logged in 20 year cycles. In the first cycle, carried out from 1976 to 1983, the first set of coupes were logged giving the forest a chessboard appearance of alternate logged and unlogged coupes.

METHODS: Reptiles and amphibians were surveyed by methods such as turning logs, rocks and bark, checking hollow logs, raking through leaf-litter, driving along roads and tracks and listening for frog calls. Surveys were carried out each month from August to December 1980 (a total of 260 person days). The forest was resurveyed within a fortnight of the 18 November 1980 fire, and then each December from 1981 until 1984 (at 30 person days per year). Observations were also made in other months of the year during studies of other animal groups.

The status of reptiles and amphibians in the area are defined in this paper as common, uncommon or rare. Common is defined as a species which was regularly seen over a wide area. An uncommon species was one which was only seen occasionally, even though it may have been abundant in a restricted area. A rare species was one which was seen very infrequently and was never abundant. Voucher specimens of each species were deposited in the Australian Museum, Sydney. The nomenclature in this paper follows Cogger *et al.* (1983).

RESULTS: A total of 21 species of reptiles (eight families) and 12 species of amphibians (two families) were recorded in the survey area (Table 1, Appendix 1). Skinks (eight species) and elapid snakes (six species) represented the majority of the reptile fauna. Except for one snake species (*Notechis scutatus*), all the herpetofauna had been found by the end of 1980.

Collecting around rock outcrops yielded very little except immediately following the fire when they were used as refuges by some reptiles. On Mumbulla Mountain where extensive rock outcrops occur, there were surprisingly few reptiles. Consequently, rotting logs, stumps, loose sheets of bark and leaf litter provided the predominant shelter in the coastal forests.

The status of each species (Table 1) shows that 13 species (eight reptiles, five frogs) were common, and that 13 species (10 reptiles, three frogs) were rare in the area. The distribution of the reptiles and amphibians, given in Table 1, shows that of the 33 species, 28 were in State Forest, including the former Tanja State Forest, 18 were in the coastal part of the national park and only 11 were on cleared farms. The five species not present in State Forest were a sea snake, (*Pelamis platurus*), a tortoise, (*Chelodina longicollis*), two frogs of swamps and ponds, (*Litorea aurea, Limnodynastes dumerilii*), and a snake-lizard, (*Pygopus lepidopodus*) which was not found in the forest despite an extensive search for this species.

The habitats in which the species were found are shown in Table 1. Ten species (three reptiles and seven frogs) were found solely in creeks, rivers or ponds. Only four of the 12 species of frogs were found in the forest. Of the 21 species of reptiles, 18 were found in the forest, all of which occurred both on ridges and in gullies, except for *Pseudonaja textilis* where the sole individual (a road kill) was found on the midslope. However, some species, such as *Egernia saxatilis, Lampropholis mustelina, Leiolopisma platynotum, Sphenomorphus tenuis, S. tympanum* and *Acanthophis antarticus* preferred the moister gully habitat. Pre-fire comparison of unlogged forest, forest logged during the woodchip operations, and the TSI showed little difference in species composition and no species was confined solely to unlogged forest. The differences were only of species that were rare for these forests, and does not allow conclusions to be drawn on the effects of logging in these species. In contrast, the pre to post fire comparison shows that each habitat had a loss of species, and two species (*E. saxatilis* and *Pseudechis porphyriacus*) were never seen in any burnt forest habitat.

DISCUSSION: The herpetofaunal assemblage in the area is typical of the warm temperate zoogeographic subregion of Rawlinson (1969). A number of the species are at, or near, the southern limit of their distribution on the far south coast of NSW; two (*L. platynotum* and *S. tenuis*) are not known south of the survey area, and others such as *A. antarticus, Tiliqua scincoides, Morelia spilota, P. textilis, Pygopus lepidopodus, Mixophyes balbus, Heleioporus australiacus* and *Litoria peroni* only marginally extend

further south than Eden (Cogger 1983). The 13 species listed as rare for this area are known to be common in other parts of their range.

The continued searching from 1981 to 1984, which yielded no further increase in species (except for *N. scutatus* in December 1981), gives us confidence in concluding that all species of reptiles and frogs that currently occur in the area were found. This statement can rarely be made for any area, and it presents the current findings as a good base line for ecological studies and assessment of change, particularly after the second logging cycle by about 2020. It also allows us to be confident that some species, such as the white-lipped Snake, *Drysdalia coronoides*, the skink, *Hemiergis maccoyi*, and the Booroolong Frog, *Litoria booroolongensis*, which all occur to the west in the high country, do not extend to the coast at Bega, and that other species, such as White's Skink, *Egernia whitii*, which might have been expected judging from general distribution maps, were not present.

Two of the 18 species of forest reptiles were not seen again following the fire. The intensity of the post-fire search effort allows us to conclude that fire excluded these species from the forest. Their recovery will be dependent upon recolonization from unburnt forest. Thus management policies need to aim to retain unburnt areas and recognize that fire, including control burning, diminishes the chances of recovery of these species.

At the end of the first logging cycle (1983) there was no loss of species and all species had been found in either logged or TSI forest. However, if any species is dependent upon resources in unlogged forest, they will be under threat following the second logging cycle. Their survival will be dependent upon the extent to which unlogged forest has been set aside.

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ACKNOWLEDGEMENTS

We particularly wish to thank Nick Oakes, Steve Phillips, Malcolm Purvis and Richard Wells for their contribution as herpetologists over many field trips; we also wish to thank Dean Metcalfe and Ross Wellington for their herpetological contribution in 1980 and Richard Wells for help with the manuscript. We are indebted also to Anne Breckwoldt, Chris Moon and Bill O'Shea for assistance in the field. We thank the Forestry Commission of NSW, particularly the local staff, for their support throughout the project. Finally, we also thank Elizabeth Ashby, Bob Bridges, Dick Curtin, Peggy Eby, Leighton Llewellyn, Harry Recher and Richard Shine for critically reading the manuscript.

Table 1. Status, distribution and habitat preferences of reptiles and amphibians in study area. The coastal national park does not include the extension westward into what was formerly Tanja State Forest. The animals of this habitat are in the forest category (SF = State Forest; cnp = coastal national park; ub = unburnt; b = burnt; TSI = timber stand improved; status, R = rare, UC = uncommon; C = common).

	Area		Forest Habitat unlogged		Forest Habitat logged		TSI		Creeks and	Cleared	Status		
	SF	CNP	ub	b	ub	b	ub	b	rivers	farms	R	UC	C
REPTILIA													
C. longicollis									*	*		*	
P. lepidopodus		*									*		
A. muricatus	*	*	*	*	*	*	*	*					*
P. lesueurii	*								*			*	
V. varius	*	*	*	*	*	*	*	*		*			*
E. saxatilis	*	*	*		*		*				*		
L. delicata	*	*	*	*	*	*	*	*		*			*
L. guichenoti	*	*	*	*	*	*	*	*		*			*
L. mustelina	*	*	*	*	*	*	*	*					*
L. platynotum	*	*	*				*	*			*		
S. tenuis	*	*	*	*			*	*			*		
S. tympanum	*	*	*	*	*	*	*	*	*	*			*
T. scincoides	*	*	*	*	*	*				*	*		
M. spilota	*	*	*		*			*			*		
A. antarcticus	*			*		*		*			*		
C. nigrescens	*	*	*	*	*	*	*	*					*
D. rhodogaster	*	*	*	*	*	*	*	*					*
N. scutatus	*							*			*		
P. porphyriacus	*		*		*		*			*		*	
P. textilis	*						*				*		
P. platurus		*									*		
AMPHIBIA													
L. aurea									*	*		*	
L. citropa	*				*		*		*			*	
L. lesueuri	*								*				*
Lit. peronii	*								*	*			*
L. phyllochroa	*								*				*
L. verreauxii	*								*	*			*
H. australiacus	*					*					*		
L. dumerilii		*										*	
Lim. peronii	*								*		*		
M. balbus	*								*		*		
P. bibronii	*	*	*		*		*		*			*	
R. signifera	*	*					*		*	*			*
Total	28	18	15	11	14	11	16	13	13	11	13	7	13

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Appendix 1

Annotated list of Amphibians and Reptiles of the coastal area near Bega, New South Wales

AMPHIBIA

Family Hylidae

Litorea aurea. Green and Golden Bell Frog. Uncommon; found only in farm dams on the lower reaches of the Murrah River.

Litoria citropa. Blue Mountains Tree Frog. Uncommon; found along Mumbulla Creek and Knights Creek either in rock crevices during the day or calling from boulders during rainy, warm evenings. One specimen was also taken on a logged ridge in the eastern part of Mumbulla State Forest from beneath a slab of bark on a snig track.

Litoria lesueuri. Lesueur's Frog. Common along Mumbulla Creek and the Murrah River. Mostly found in the vicinity of riffles and the more densely vegetated creek edges.

Litoria peronii. Peron's Tree Frog. Common along Mumbulla Creek, Murrah River, and around temporary waterholes in the eastern part of Mumbulla State Forest. Usually heard during rainy, warm evenings calling from low shrubs on the verge of creeks.

Litoria phyllochroa. Leaf Green Tree Frog. Common along Mumbulla Creek. Heard calling from boulders along flowing sections of the creek, or from leaf litter on the banks.

Litoria verreauxi. Verreaux's Tree Frog. Common throughout the forests; mainly found around temporary waterholes, and abundant along Mumbulla Creek.

Family Myobatrachidae

Heleioporus australiacus. Giant Burrowing Frog, rare; one specimen only found, dead on a stump in logged forest in the eastern part of Mumbulla State Forest; it appeared to have been killed by fire.

Limnodynastes dumerilii. Eastern Banjo Frog, uncommon; only found in a garbage pit in banksia woodland in Mimosa Rocks National Park.

Limnodynastes peronii. Brown-striped Frog, rare; only one, a male, was recorded calling from a creek in a logged part of the eastern section of Mumbulla State Forest.

Mixophyes balbus. Great Barred Frog, rare; observed only once in a creek which ran through rainforest in the eastern section of Mumbulla State Forest.

Pseudophryne bibronii. Brown Toadlet, uncommon; several specimens found trapped in a garbage pit in Mimosa Rocks National Park, in woodland. Occasionally found in the forest. Most frequent around soaks or small pools in gullies.

Ranidella signifera. Common Eastern Froglet, common throughout the forest, usually found beneath logs and stones on damp soil in gullies.

REPTILIA

Family Chelidae

Chelodina longicollis. Eastern Snake-necked Turtle, uncommon; several individuals were found on roads near Bega adjacent to flowing rivers and tributaries, marshes and ponds. No records from the Murrah river, but most likely present.

Family Pygopodidae

Pygopus lepidopodus. Common Scaly-foot, rare; this species was only recorded from the heath and rock outcrops in Mimosa Rocks National Park (Aragunnu Beach and Picnic Beach). The record from Aragunnu is based on a communal egg-laying site where a total of 76 hatched/spoiled eggs were found. One of the eggs contained the skeletal remains of a full term embryo; additionally a sloughed skin from a neonate was found in association with the eggs. The discovery of this communal egg site is the first record for this type of reproductive behaviour in this species, although it has been recorded in another species of legless lizard, *Lialis burtonis* (McPhee 1979). The record from Picnic Beach is based on a sighting of an adult in banksia heath at the northern end of the beach. L. C. Llewellyn (pers. comm.) stated that he found this species at Aragunnu.

Family Varanidae

*Varanus varius**. Lace Monitor, common; occurred throughout the area. Usually found on the ground, either foraging or basking, this species readily climbed nearby trees when disturbed. Following the extensive fire of November 1980 it remained common, being found in all habitats. Most sightings were along roads. Commonly found in Mimosa Rocks National Park particularly as a scavenger around picnic areas. (*See cover photo).

Appendix 1 (cont'd)

Family Agamidae

Physignathus lesueurii howittii. Gippsland Water Dragon, uncommon; few sightings were recorded as most of the creeks had dried up due to the drought. However, more permanent watercourses such as Nelson and Mumbulla Creeks and, to a lesser extent, Knights Creek have breeding colonies. Numerous individuals were sighted along the Murrah River, particularly around groves of huge casuarinas and around extensive rock outcroppings. One individual sighted was estimated to be over a metre in length.

*Amphibolurus muricatus**. Jacky lizard, common throughout the forest and coastal banksia heath in Mimosa Rocks National Park. Gravid specimens were found in December. This species was usually observed basking on logs, branches or low shrubs or active on the ground; when disturbed, they rapidly retreated into low vegetation or climbed trees. One individual was observed eating a centipede. This species was present in the forest in all post-fire years. It was more commonly seen on logged, burnt ridges than in other habitats.

Family Scincidae

Egernia saxatilis. Black Rock Skink, rare; mainly found in the western part of Mumbulla State Forest beneath loose bark of dead silver top ash and ironbark. Several were observed beneath bark on stumps, or hollow fallen trees, including the TSI area. However, this species was less common in the disturbed forests to the east and was not recorded in the forest after the fire. Isolated populations were found in Mimosa Rocks National Park in coastal rock outcroppings. Some specimens were found in the littoral zone.

Lampropholis delicata. Common, particularly in sites with deep leaf-litter, and on ridges with *Danthonia* tussocks, into which it retreated when disturbed. Gravid specimens were found in December. Also found in Mimosa Rocks National Park. It was rare in the TSI area, presumably because of the extensive shading. Although commonly seen after the fire, its numbers were lower. The long drought also reduced the numbers.

Lampropholis guichenoti. Common, the most abundant reptile in the study area. Found in all habitats, usually basking or foraging in leaf litter, or under logs, rocks or in the soil. Commonly occurred in Mimosa Rocks National Park. An unusual green variation of this species was found on the boulder-bed of the Murrah River. It was rare in the TSI area, and the major effect of the drought was on the ridge populations.

Lampropholis mustelina. Weasel Skink, common throughout area. Usually associated with the dense, moist gully habitats beneath logs and stones on damp soil or dense leaf-litter. Gravid specimens were observed in December; one found actually laying, beneath a log on damp soil on the south-west aspect of a logged ridge on 8 December, 1980. This species was hard to see pre-fire because of its preference for remaining in the leaf litter, but in the immediate weeks following the fire it was easily seen.

Leiolopisma platynotum. Red-throated Skink, rare; mainly observed in the granite TSI areas in the western part of the forest. Found either basking on granite and surrounding litter or beneath exfoliations on northern or western exposed outcrops. Also found in Mimosa Rocks National Park.

Sphenomorphus tenuis. Rare; mainly in the granite TSI habitat of the western part of the forest. Usually discovered sheltering beneath loose bark of stumps and trunks of silvertop ash and ironbark. A specimen was occupying a hole in an ironbark trunk that fell across a road; the hole was about 15 m above the ground when the tree was standing. Another adult was observed active in a hollow limb about 4 m above the ground in Mimosa Rocks National Park. The presence of *S. tenuis* in the area represents a new southern limit of the species range, an extension of nearly 200 km from the nearest known population.

Sphenomorphus tympanum. Water Skink, common; most frequently found along creeks and rivers, gullies, and, in the dense TSI, usually basking on logs, or foraging amongst dense ferns and litter. Gravid specimens were found in December. One individual was observed feeding on a large centipede; stomach contents contained adult *Lampropholis guichenoti* as well as invertebrates. Other individuals were seen feeding on winged termites. Most often observed active during warm, cloudy and humid weather, particularly after rain in summer. This species occurred in only low numbers in the recently logged, exposed coupes.

Tiliqua scincoides. Eastern Blue-tongued Lizard, rare; this species was found in the forests in low numbers. Only five sightings were made, all were adults, four were on roads, and one was in a small mammal trap, in the eastern part of the forest.

Family Typhlopidae

Ramphotyphlops sp. We did not locate any specimens, despite the records from Bega in the Australian Museum. It is possible that such records may have originated from the ranges to the immediate west of Bega, rather than the lower coastal sites of our study area.

Appendix 1 (cont'd)

Family Boidae

*Morelia spilota**. Diamond Python, rare; occasionally found basking in gullies, on ground litter, or on roads. Most sightings were from the eastern part of Mumbulla S.F. and in Mimosa Rocks National Park. One specimen collected at Mimosa Rocks N.P. contained an adult water rat, *Hydromys chrysogaster,* in its stomach.

Family Elapidae

*Acanthophis antarcticus**. Common Death Adder, rare; usually in the granite western part of Mumbulla S.F. but also known from the shale areas in the east. Most often observed basking on ground litter in gullies or on roads; one found inside a large hollow log on a logged ridge. No specimens were located until after the November 1980 fire. We attributed this to the loss of leaf litter and shrubs, thereby making this cryptic species easier to find.

Cryptophis nigrescens. Eastern Small-eyed Snake, common; found sheltering beneath stones and bark on soil in both gullies and ridges. Occasionally found beneath slabs of discarded bark near log dumps; also found in Mimosa Rocks National Park.

Drysdalia rhodogaster. Common throughout area. Usually found active on ground litter along ridges but also observed in gullies; occasionally discovered sheltering beneath logs and bark on soil along verges of roads; on log dumps and among *Danthonia* tussock clearings along ridges. One individual was seen eating a *Lampropholis delicata*.

*Notechis scutatus**. Mainland Tiger Snake, rare; one mature specimen found on a road adjacent to a tributary of Wapengo Creek. The other was also seen on a road on a ridge in the central part of Mumbulla S.F.

Pseudechis porphyriacus. Red-bellied Black Snake, uncommon and widespread before the fire. Occasionally found basking in dense ground vegetation in gullies. Also sighted on roads but rarely on the TSI ridges. Rarely sighted during the drought. One individual found dead following the fire in November 1980 and none found in burnt forest. Found in Mimosa Rocks N.P. and cleared farmland.

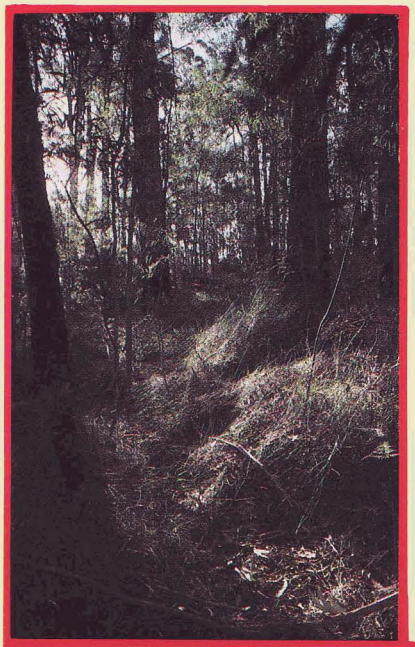
Pseudonaja textilis. Eastern Brown Snake, rare; recorded from one specimen only, which was found dead on Mumbulla Creek Road near the picnic area on Mumbulla Creek, in October 1980. There are records from the Bega District, but all are over 50 years ago. It is possible that this species is declining on the south coast as recent records south of Sydney are rare.

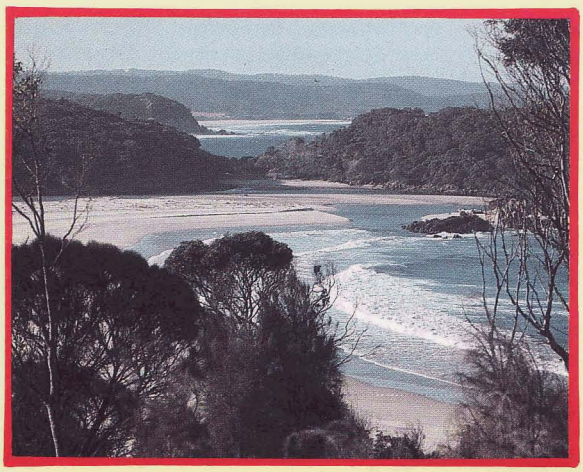
*See photo page 9.

Family Hydrophiidae

Pelamis platurus. Yellow-bellied Sea Snake, rare; two specimens found; one washed up on Aragunnu Beach, the other on Picnic Beach in Mimosa rocks N.P.

Contrasting habitats of surveyed coastal forest near Bega, NSW





Unlogged, unburnt gully in Mumbulla State Forest (top left)

Logged forest, immediately after fire (centre left)

Aerial view of a logged coupe 20 months after fire Mumbulla State Forest. Photo also shows adjacent unlogged coupes, a forestry road for log trucks and a log dump on the ridge in the logged coupe (lower left)

Mimosa Rocks National Park, looking north from Wajurda Point across Nelson Beach, then Baronda Head and Cowdroy's Beach (lower right)

Photos: Daniel Lunney

Diamond Python, *Morelia spilota*, this species was rare in the area (top left).

Photo: Daniel Lunney

Tiger Snake, *Notechis scutatus*, only two individuals were seen and were characterised by their dark colouring as shown here (top right).

Photo: Daniel Lunney

Jacky Lizard, *Amphibolurus muricatus*, this widespread species was found more frequently on logged burnt ridges than in any other habitat (centre right).

Photo: John Barker

Death Adder, *Acanthophis antarcticus*, this cryptic species, found mainly in gullies, was not seen until after fire removed the leaf litter cover (lower right).

Photo: Daniel Lunney

Rare and not so rare reptiles seen in fire-affected coastal NSW forests